Proceedings of the American Academy of Arts and Sciences.

VOL. XXXVIII. No. 26. — JULY, 1903.

(TITLE PAGE AND TABLE OF CONTENTS.)

RECORDS OF MEETINGS.

Nine hundred and thirty-third Meeting.

OCTOBER 8, 1902. — STATED MEETING.

The PRESIDENT in the chair.

The Corresponding Secretary announced that letters had been received from Arthur James Balfour and W. E. H. Lecky, acknowledging their election as Foreign Honorary Members; from the Chief of the Department of Liberal Arts, World's Fair, St. Louis, inviting the Academy to make an exhibit of the work of its members; and from the International Botanical Congress, regarding the organization of the session at Vienna in 1905. Letters from the Trustees of Princeton University, inviting the Academy to be represented by a delegate at the inauguration of Woodrow Wilson as President of the University, and from the Trustees and Faculties of Northwestern University, requesting the Academy to appoint one or more delegates to the installation of Edmund Janes James as President of the University, were referred to the Executive Committee.

Letters were also received announcing the death of H. von Wild and Gaetano Negri; the institution of a section of terrestrial magnetism and seismology at the Royal Meteorological Institute of the Netherlands; the reorganization of the National Museum at Buenos Ayres; inviting the President and Secretary to the Jubilee Meeting of the North of England Institute of Mining and Mechanical Engineers.

The Chair announced the following deaths: —

John Daniel Runkle, Class I., Section 1; Horatio Hollis Hunnewell, Class II., Section 2; Horace Gray, Class III., Section 1; Charles Greely Loring, Class III., Section 4, Resident Fellows.

John Wesley Powell, Class II., Section 1, Associate Fellow.

Hervé Auguste Etienne Albans Faye, Class I., Section 1; Heinrich von Wild, Class II., Section 1; Rudolf Virchow, Class II., Section 4, Foreign Honorary Members.

On the motion of the Corresponding Secretary, it was

Voted, To meet, on adjournment, on the 12th of November.

The following gentlemen were elected members of the Academy: —

Harry Walter Tyler, of Boston, to be a Resident Fellow in Class I., Section 1 (Mathematics and Astronomy).

Alfred Edgar Burton, of Boston, to be a Resident Fellow in Class I., Section 4 (Technology and Engineering).

Hugo Münsterberg, of Cambridge, to be a Resident Fellow in Class III., Section 1 (Philosophy and Jurisprudence).

Frederic Jesup Stimson, of Boston, to be a Resident Fellow in Class III., Section 1.

Arthur Twining Hadley, of New Haven, to be an Associate Fellow in Class III., Section 3 (Political Economy and History).

Luigi Cremona, of Rome, to be a Foreign Honorary Member in Class I., Section 1 (Mathematics and Astronomy), in place of the late Charles Hermite.

Joseph John Thomson, of Cambridge, to be a Foreign Honorary Member in Class I., Section 2 (Physics), in place of the late Marie Alfred Cornu.

Emil von Behring, of Marburg, to be a Foreign Honorary Member in Class II., Section 4 (Medicine and Surgery).

John Morley, of London, to be a Foreign Honorary Member in Class III., Section 3 (Political Economy and History).

The President gave an account of his explorations of the coral reefs of the Maldives.

H. Helm Clayton read a paper entitled "On the Observed Movements of the Dust from the Volcanic Eruptions in the West Indies."

Edward Atkinson, in presenting the first two copies of a complete report issued by the Experiment Station in Insurance Engineering on Diffusion of Light and Corrosion of Steel, said:

"In our practice as underwriters we are called upon to deal with heat and light from a very different point of view as compared to that of pure science. In order to be prepared for questions in the future on so-called fire-proof construction, corrosion, and other matters, I have called upon my clients in the Factory Mutual Companies to assess themselves at the rate of one cent per hundred dollars of their insurance and to place in my hands a sum of money to be expended in what I have named the Insurance Engineering Experiment Station. In response I have received between fifteen thousand dollars ($15,000) and sixteen thousand dollars ($16,000), in spending which I have a free hand: but I have placed myself under an Advisory Committee consisting of the Directors of the Insurance Company of which I am President; chiefly under the advice of the Executive Committee, Messrs. Arthur T. Lyman, Howard Stockton, and Theophilus Parsons.

"We are about to have a sufficient area of land placed at our disposal on a long lease, and the representatives of various types of fire-proof construction are each to put up a building which shall be tested by fire and water and lapse of time, but which will also serve more than ample for our laboratories and experiments.

"All this is preliminary to laying out a course of instruction in Insurance Engineering and a year hence transferring the control of the Station to the Institute of Technology.

"In the interval if any members of the Academy want an opportunity to apply high temperature at or above the melting-point of cast-iron for a considerable period of time, we expect to have buildings of ten or twelve foot cube constructed for that purpose, and shall place them at their disposal.

"I will send to any member any reasonable number of copies of the report on the Diffusion of Light and the Corrosion of Steel on application by card addressed to my office, as we have issued a very large edition in order to interest men of Science, architects, and engineers in the general subject."

The following papers were presented by title:—

Contributions from the Harvard Mineralogical Museum.—XII. (1) "Babingtonite from Somerville, Mass." (2) "Babing-

tonite from Athol, Mass." By C. Palache and F. A. Fraprie. Presented by J. E. Wolff.

"On the Thermal Development of the Spark Spectrum of Carbon." By Henry Crew and John C. Baker. Presented by Charles R. Cross.

Nine hundred and thirty-fourth Meeting.

NOVEMBER 12, 1902. — ADJOURNED STATED MEETING.

VICE-PRESIDENT TROWBRIDGE in the chair.

The Corresponding Secretary announced that letters had been received from Hugo Münsterberg, F. J. Stimson, H. W. Tyler, accepting Resident Fellowship; Arthur T. Hadley, acknowledging election as Associate Fellow; E. v. Behring, John Morley, acknowledging election as Foreign Honorary Members; C. A. Young, accepting his appointment as representative of the Academy at the inauguration of the President of Princeton University; T. C. Chamberlin, accepting his appointment as delegate of the Academy at the installation of the President of Northwestern University; the Royal Academy of Sciences of Turin, announcing the death of its President, Alfonso Cossa; the Central Meteorological Institute of Sweden, announcing the death of its former Director, Robert Rubenson; and the Nobel Committee for Chemistry and the Nobel Committee for Physics of the Royal Academy of Sciences of Sweden, inviting competition for the Nobel prizes for 1903.

The following papers were presented: —

"The Fall of the Campanile of San Marco." By Arlo Bates.

"Recent Studies of the Lunar Surface." By William H. Pickering.

The Committee of Publication reported the acceptance of the following articles since the Annual Meeting: —

Contributions from the Chemical Laboratory of Case School of Applied Science. — XLII. "An Apparatus for Continuous Vacuum Distillation." By Charles F. Mabery.

Contributions from the Gray Herbarium of Harvard Uni-

versity. New Series. — No. XXIV. (Papers from the Hopkins-Stanford Expedition to the Galapagos Islands.) By B. L. Robinson. I. — "Flora of the Galapagos Islands."

Contributions from the Chemical Laboratory of Harvard College. "Concerning Gas-Analysis by Measurement in Constant Volume under Changing Pressure." By Theodore William Richards.

Contributions from the Chemical Laboratory of Case School of Applied Science. — XLIV. "A Method for Determining the Index of Refraction of Solid Hydrocarbons with the Pulfrich Refractometer. Index of Refraction of the Solid Hydrocarbons in Petroleum." By Charles F. Mabery and Lee Shepherd.

Contributions from the Chemical Laboratory of Harvard College. "The Significance of Changing Atomic Volume. III. The Relation of Changing Heat Capacity to Change of Free Energy, Heat of Reaction, Change of Volume, and Chemical Affinity." By Theodore William Richards.

Contributions from the Chemical Laboratory of Harvard College. "The Speed and Nature of the Reaction of Bromine upon Oxalic Acid." By Theodore William Richards and Wilfred Newsome Stull.

Contributions from the Chemical Laboratory of Harvard College. "The Range and Invariability of Faraday's Law." By Theodore William Richards and Wilfred Newsome Stull.

Contributions from the Chemical Laboratory of Harvard College. "An Apparatus for the Measurement of the Expansion of Gases by Heat under Constant Pressure." By Theodore William Richards and Kenneth Lamartine Mark.

Contributions from the Chemical Laboratory of Harvard College. "The Transition Temperature of Sodic Sulphate referred anew to the International Standard." By Theodore William Richards and Roger Clark Wells.

Nine hundred and thirty-fifth Meeting.

DECEMBER 10, 1902.

The PRESIDENT in the chair.

The Corresponding Secretary read letters from L. Cremona and J. J. Thomson, acknowledging their election as Foreign Honorary Members; and from the Entomological Society of Belgium, announcing the death of its President, Pierre-Jules Tosquinet.

The President announced the following deaths: —

Henry Mitchell, Resident Fellow in Class I., Section 1.

Ogden Nicholas Rood, Associate Fellow in Class I., Section 2.

Alfred Richard Cecil Selwyn, Associate Fellow in Class II., Section 1.

The following papers were presented: —

"Results obtained from the Use of Quartz Geissler Tubes in Spectrum Analysis." By John Trowbridge.

"A Theory of Tone-Relations — Colors, Intensities, Neutrality, Values." By Denman W. Ross.

The following paper was presented by title: —

"The Pressure due to Radiation." By E. F. Nichols and G. F. Hull. Presented by C. R. Cross.

Nine hundred and thirty-sixth Meeting.

JANUARY 14, 1903. — STATED MEETING.

VICE-PRESIDENT TROWBRIDGE in the chair.

On the motion of the Recording Secretary, it was

Voted, To meet on adjournment on the second Wednesday in February.

On the recommendation of the Rumford Committee, it was

Voted, To appropriate from the income of the Rumford Fund one hundred dollars ($100) for the preparation of a catalogue of the books on light and heat in the library of the Academy.

Voted, To transfer the appropriation of seven hundred and fifty dollars ($750), granted to Theodore W. Richards at the annual meeting of 1902, toward the prosecution of researches

on the thermodynamical properties of chemical substances involved in chemical reactions.

Voted, To appropriate three hundred dollars ($300), from the income of the Rumford Fund to George E. Hale, of the Yerkes Observatory, for the purchase of a Rowland concave grating to be used in the photographic study of the spectra of the brightest stars.

On the motion of E. L. Mark, with the written approval of the Committee of Finance, it was

Voted, To appropriate from the income of the General Fund two hundred and fifty dollars ($250) for publishing.

The following papers were read: —

"Account of some Lunar phenomena." By N. S. Shaler.

"Some Recent Studies on Immunity." By W. T. Councilman.

The following papers were presented by title: —

"Mendel's Law of Heredity." By W. E. Castle.

"Synopsis of the Genus Lonicera." By Alfred Rehder. Presented by E. L. Mark.

"On the Temperature Coefficient of Chilled and Seasoned Cast Iron Magnets." By B. O. Peirce.

Nine hundred and thirty-seventh Meeting.

FEBRUARY 11, 1903. — ADJOURNED STATED MEETING.

VICE-PRESIDENT WALCOTT in the chair.

The Chair announced the following deaths: —

Morrill Wyman, of Class I., Section 4; James Elliot Cabot, of Class III., Section 4, Resident Fellows.

Sir George Gabriel Stokes, Baronet, of Class I., Section 2, Foreign Honorary Member.

Harold C. Ernst read a paper entitled, "A New Method of Stating Ehrlich's Theory of Immunity."

The following paper was presented by title: —

"Diffusion, Supersaturation, and the Metastable Limit." By Harry W. Morse and George W. Pierce. Presented by John Trowbridge.

Nine hundred and thirty-eighth Meeting.

March 11, 1903. — Stated Meeting.

The Recording Secretary in the chair.

The Chair announced the death of Gaston Bruno Paulin Paris, Foreign Honorary Member in Class III., Section 4.

The Chair appointed the following councillors to serve as Nominating Committee: —

Charles R. Sanger, of Class I., Theobald Smith, of Class II., A. Lawrence Lowell, of Class III.

The following persons were elected members of the Academy:

George Ashley Campbell, of Boston, to be a Resident Fellow in Class I., Section 2 (Physics).

Albert Sauveur, of Cambridge, to be a Resident Fellow in Class I., Section 4 (Technology and Engineering).

Samuel Franklin Emmons, of Washington, to be an Associate Fellow in Class II., Section 1 (Geology, Mineralogy, and Physics of the Globe), in place of the late Clarence King.

Alfred Thayer Mahan, of New York, to be an Associate Fellow in Class III., Section 3 (Political Economy and History).

Karl Alfred Ritter von Zittel, of Munich, to be a Foreign Honorary Member in Class II., Section 1 (Geology, Mineralogy, and Physics of the Globe), in place of the late Friherre Adolf Erik Nordenskiöld.

The following papers were read: —

"The Pompeian Fresco called 'The Judgment of Solomon.'" By Morris H. Morgan.

"Origin of the Great Mountain Ranges." By William M. Davis.

Nine hundred and thirty-ninth Meeting.

April 8, 1903.

The Academy met in the Geological Lecture Room of the Harvard University Museum, Cambridge.

The President in the chair.

In the absence of the Recording Secretary, W. M. Davis was appointed Secretary *pro tempore*.

The Chair announced the death of Henry Barker Hill, Resident Fellow in Class I., Section 3.

The following papers were presented by title: —

"On Families of Curves which are the Lines of Certain Plane Vectors either Solenoidal or Lamellar. By B. O. Peirce.

"On the Thermal Conductivities of Certain Pieces of Rock from the Calumet and Hecla Mine." By B. O. Peirce.

Contributions from the Gray Herbarium. New Series, No. XXV. "A Revision of the Genus Flaveria." By J. R. Johnston. Presented by B. L. Robinson.

"Spectra of Gases and Metals at High Temperatures." By John Trowbridge.

The grounds for the award of the Rumford Premium to George E. Hale, of the Yerkes Observatory, were stated by Charles R. Cross, chairman of the Rumford Committee. The medals were presented by the President, and Professor Hale responded, illustrating his recent researches in solar and stellar physics with projections on the screen.

The following exhibits in the adjoining halls of the Museum were then inspected: —

"Demonstration of some Phenomena of Optical Mineralogy." By J. E. Wolff.

"Photomicrographic Illustrations of North American Woods." By E. C. Jeffrey.

"The Soltwedel Plates of Sugar Cane." By G. L. Goodale.

"Plant Dissections, Illustrating the Study of Herbarium Specimens." By B. L. Robinson.

"Some Recent Discoveries in the New England Flora." By M. L. Fernald.

"A Method of Keeping Ornithological Notes." By William Brewster.

"Types of Indian Basketry." By F. W. Putnam and W. C. Willoughby.

"Phonograph Records of Indian Songs and Note Books of Indian Languages." By R. B. Dixon.

"Model of the Cahokia Mound Group." By F. W. Putnam and D. I. Bushnell, Jr.

"Illustrations of the Effects of the Earth's Rotation." By W. M. Davis.

"Selected Views from the Gardner Collection of Geological and Geographical Photographs." By P. S. Smith.

"Specimens of Fossil Brachiopods showing Details of Structure." By R. T. Jackson.

"A Two-Circle Goniometer, and a Collection of Cleaved Mineral Forms." By C. Palache.

"Rocks and Coals from the Rhode Island Coal Field, and other Specimens." By J. B. Woodworth.

"Recent Meteorological Charts and Atlases." By R. DeC. Ward.

"Cuspate Capes of our Atlantic Coast." By M. A. Read.

"Recent Folios of the Geologic Atlas of the United States." By L. Laforge.

"Thin Sections and Microphotographs of North American Woods." By E. C. Jeffrey.

"Contributions from the Cryptogamic Laboratories." By R. Thaxter.

Nine hundred and fortieth Meeting.

ANNUAL MEETING. — MAY 13, 1903.

VICE-PRESIDENT WALCOTT in the chair.

The following letters were read: —

From Albert Sauveur, accepting Fellowship; S. F. Emmons, A. T. Mahan, acknowledging election as Associate Fellows; Ed. Mazelle, announcing his appointment as Director of the Astronomical-Meteorological Observatory of Trieste.

The Chair announced the following deaths: —

William Sumner Appleton, Resident Fellow in Class III., Section 2; Josiah Willard Gibbs, Associate Fellow in Class I., Section 2.

The annual report of the Council was read by the Recording Secretary.

In the unavoidable absence of the Treasurer, and at his request, the Recording Secretary read the annual report of the Treasurer, of which the following is an abstract: —

General Fund.

Receipts.

Balance, April 30, 1902		$272.42
Investments	$5,824.68	
Assessments	985.00	
Admission fees	50.00	
Sales of publications	81.84	6,941.52
		$7,213.94

Expenditures.

General expenses		$2,916.42
Publishing	$2,962.86	
Library	1,200.83	
Catalogue	104.70	4,268.39
Balance, April 30, 1903		29.13
		$7,213.94

Rumford Fund.

Receipts.

Balance, April 30, 1902		$ 381.96
Investments	$2,651.31	
Sale of publications	4.07	2,655.38
		$3,037.34

Expenditures.

Researches	$2,015.00	
Medals	331.50	
Publishing	323.11	
Library	154.07	
Miscellaneous	15.87	$2,839.55
Balance, April 30, 1903		197.79
		$3,037.34

Warren Fund.

Receipts.

Balance, April 30, 1902		$ 760.72
Investments	$1,030.19	
Appropriation refunded	130.66	1,160.85
		$1,921.57

Expenditures.

Investigations	$ 760.00
Balance, April 30, 1903	1,161.57
	$1,921.57

Building Fund.

Receipts.

Balance, April 30, 1902	$ 689.55
Investments	665.37
	$1,354.92

Expenditures.

Income invested and transferred to capital account	$1,250.00
Balance, April 30, 1903	104.92
	$1,354.92

The following reports were also presented: —

Report of the Librarian.

The card-catalogue has been continued by the Assistant Librarian, who has type-written 2615 cards, making the total number of cards 6300. All the books on light and heat, constituting with periodicals not yet catalogued, the Rumford Library, have been catalogued, besides the books on chemistry, engineering, the useful arts and general natural history, and some 200 books on miscellaneous subjects. The usual appropriation of $100 from the income of the General Fund is requested for continuing this work, and $50 is requested from the income of the Rumford Fund for the same purpose.

The accessions during the year have been as follows: —

	Vols.	Parts of vols.	Pams.	Maps.	Total.
By gift and exchange . . .	507	2155	249	24	2935
By purchase — General Fund	35	512			547
By purchase — Rumford Fund	22	251	2		272
Total	564	2918	251	24	3757

21 volumes and 2 pamphlets on light and heat, recommended by the Rumford Committee, were bought at an expense of $68.96.

. . . . . .

The expenses charged to the Library are as follows: — Miscellaneous, which includes expenses in no way related to the Library, $602.27; Binding, $324.02, General, and $40.23, Rumford Funds; Subscriptions, $274.54, General, and $113.94, Rumford Funds; making a total of $1200.83 for the General and $154.07 for the Rumford Funds. An appropriation of $1400 from the income of the General Fund is requested in addition to the customary appropriation of $150 from the income of the Rumford Fund for the purchase of books and periodicals.

A. Lawrence Rotch, *Librarian.*

Report of the Rumford Committee.

At the last Annual Meeting of the Academy, May 4, 1902, the sum of $1000 was placed at the immediate disposition of the Committee for use in furtherance of research. During the year which has elapsed since that date, the following grants have been made from this appropriation.

Dec. 10, 1902. One hundred and fifty dollars to Dr. Ralph S. Minor of Little Falls, N. Y., in aid of his research on the dispersion and absorption of substances for ultra-violet radiation.

Jan. 14, 1903. One hundred dollars to Dr. Sidney D. Townley of Berkeley, California, for the construction of a stellar photometer of the type devised by Professor Pickering.

Jan. 14, 1903. Two hundred dollars to Professor E. B. Frost for the construction of a special lens for use in connection with the stellar spectograph of the Yerkes Observatory to aid in the study of the radial velocities of faint stars.

Jan. 14, 1903. Two hundred and fifty dollars to Professors E. F. Nichols and G. F. Hull of Dartmouth College, in aid of their investigation on the relative motion of the earth and the ether by the method of Fizeau's polarization experiment. It was subsequently voted (April 8, 1903), to allow the grantees to change the application of this grant to

an investigation of the effect of the motion of the earth on the intensity of radiation.

Feb. 11, 1903. One hundred and fifty dollars to Professor E. C. Pickering for the construction of two stellar photometers to be placed at the disposal of the Committee. It was furthermore voted that one of these be placed at the disposal of the Rev. Edmund Goetz, Director of the Southern Station of the Georgetown College Observatory.

The following votes have also been passed by the Committee: —

Dec. 10, 1902. That the Academy be recommended to appropriate one hundred dollars from the income of the Rumford Fund for the preparation of a catalogue of the books on light and heat in the library of the Academy, this being the second appropriation for the purpose.

Jan. 14, 1903. To recommend to the Academy the transfer of the appropriation of seven hundred and fifty dollars voted to Professor Theodore W. Richards at the Annual Meeting of 1902, toward the prosecution of an extended series of researches on the thermo-dynamics of substances involved in chemical reactions.

Jan. 14, 1903. To recommend to the Academy the appropriation of three hundred dollars from the income of the Rumford Fund to Professor George E. Hale of the Yerkes Observatory for the purchase of a Rowland concave grating to be used in the photographic study of the spectra of the brighter stars.

These recommendations were acted upon favorably by the Academy.

April 8, 1903. To request the Academy to appropriate from the income of the Rumford Fund the sum of seventy-five dollars to Mr. F. L. Bishop of the Bradley Polytechnic Institute in aid of his investigation on the thermal conductivity of lead; and also to appropriate the sum of two hundred dollars to Professor Frederick A. Saunders of the Syracuse University in aid of an investigation on the characteristics of the spectra produced under varying conditions, as specified in his application.

Feb. 11, 1903. To ask the Academy to appropriate from the income of the Rumford Fund the sum needed to purchase and bind certain books upon light and heat.

April 8, 1903. To ask the Academy to appropriate from the income of the Rumford Fund the sum of one hundred and fifty dollars for the purchase and binding of periodicals.

April 8, 1903. To request the Academy to appropriate the sum of one thousand dollars from the income of the Rumford Fund for the immediate needs of the Committee in furtherance of research.

May 13, 1903. To request the Academy to appropriate from the income of the Rumford Fund the sum of fifty dollars for cataloguing books and periodicals in the library of the Academy relating to light and heat.

Reports upon the progress of investigations aided by grants from the Rumford Fund have been received from Messrs. A. L. Clark, E. B. Frost, G. E. Hale, F. A. Laws, R. S. Minor, E. F. Nichols, A. A. Noyes, E. C. Pickering, T. W. Richards, S. D. Townley, R. W. Wood.

The Committee has considered the claims of a number of persons for the Rumford Premium but has decided to make no recommendation for an award this year.

CHAS. R. CROSS, *Chairman.*

REPORT OF THE C. M. WARREN COMMITTEE.

The C. M. Warren Committee has the honor to report that Professor Mabery and Professor A. A. Noyes have reported satisfactory progress in the work assisted by grants from the Warren Fund.

They regret to be obliged to announce that Professor Charles L. Jackson, owing to pressure of work, felt obliged to resign the Chairmanship of the Committee.

Professor Leonard P. Kinnicutt was elected Chairman to fill the vacancy caused by Professor Jackson's resignation.

The Committee recommends the following appropriations from the income of the C. M. Warren Fund: —

To Professor C. F. Mabery, Case School of Applied Science, Cleveland, O., to complete his researches on petroleum, for which work he has already received various grants from the C. M. Warren Fund, three hundred dollars.

To Professor H. O. Hofman, Massachusetts Institute of Technology, Boston, Mass., to complete his research on the decomposition of zinc sulphate, for which work one hundred and sixty dollars was granted last year, three hundred and fifty dollars.

To Dr. Samuel P. Mulliken, Massachusetts Institute of Technology, Boston, Mass., to assist him in continuing his investigation on a systematic procedure for the identification of compounds of carbon containing hydrogen, nitrogen, and oxygen; Professor C. L. Jackson dissenting, five hundred dollars.

LEONARD P. KINNICUTT, *Chairman.*

Report of the Committee of Publication.

The Committee of Publication begs leave to report that there have been published during the academic year 1902–3, one Memoir, Vol. V., No. 12; two numbers of Volume XXXVII. of the Proceedings, and the first twenty-three numbers of Volume XXXVIII., aggregating 812 pages and 7 plates.

Eight numbers of Volume XXXVIII. (Nos. 7, 10, 12, 14, 15, 19, 20, and 23), in all 138 pages, were printed at the cost of the Rumford Fund ($487.52). The total expenditure for printing — including $12.00 for binding — paid from the General Fund was $2962.86.

The unexpended balance May 14, 1902, was $443.00. The appropriation made at the annual meeting on that date was $2400.00. An additional appropriation of $250.00 was made Jan. 14, 1903, and the return from sales was $81.84. The total amount from the General Fund available for publication was therefore $3174.84. The unexpended balance is $211.98.

The Committee recommends for the year 1903–4 an appropriation of $2600.00.

For the Committee,

E. L. Mark, *Chairman.*

May 13, 1903.

On the recommendation of the Committee of Finance, it was

Voted, To make the following appropriations from the income of the General Fund for the expenditures of the Academy during the ensuing year: —

For general expenses		$3000
For publishing		2400
For the library		
Books and binding	$900	
Miscellaneous	500	
Catalogue	100	1500
		$6900

On the recommendation of the Rumford Committee, it was

Voted, To make the following appropriations from the income of the Rumford Fund: —

For the immediate needs of the Rumford Committee in furtherance of research, $1000.

For the purchase and binding of periodicals, $150.

For the purchase and binding of certain specified books on light and heat, $100.

For cataloguing books and periodicals in the library relating to light and heat, $50.

To F. L. Bishop, in aid of his investigation on the thermal conductivity of lead, $75.

To F. A. Saunders, in aid of his investigation on the characteristics of spectra produced under varying conditions, $200.

On the recommendation of the C. M. Warren Committee, it was

Voted, To make the following appropriations from the income of the C. M. Warren Fund: —

To C. F. Mabery, to complete his researches on petroleum, $300.

To H. O. Hofman, to complete his research on the decomposition of zinc sulphate, $350.

To S. P. Mulliken, to assist him in continuing his investigation on a systematic procedure for the identification of compounds of carbon containing hydrogen, nitrogen, and oxygen, $500.

On the motion of the Recording Secretary, it was

Voted, That the annual assessment for the ensuing year be five dollars ($5).

The annual election resulted in the choice of the following officers and committees: —

WILLIAM W. GOODWIN, *President.*
JOHN TROWBRIDGE, *Vice-President for Class I.*
HENRY P. WALCOTT, *Vice-President for Class II.*
JOHN C. GRAY, *Vice-President for Class III.*
WILLIAM M. DAVIS, *Corresponding Secretary.*
WILLIAM WATSON, *Recording Secretary.*
SAMUEL CABOT, *Treasurer.*
A. LAWRENCE ROTCH, *Librarian.*

Councillors for Three Years.

LEWIS J. JOHNSON, of Class I.
EDWARD H. BRADFORD, of Class II.
MORRIS H. MORGAN, of Class III.

Member of Committee of Finance.

ELIOT C. CLARKE.

Rumford Committee.

ERASMUS D. LEAVITT, AMOS E. DOLBEAR,
EDWARD C. PICKERING, ARTHUR G. WEBSTER,
CHARLES R. CROSS, THEODORE W. RICHARDS,
ELIHU THOMSON.

C. M. Warren Committee.

CHARLES L. JACKSON, ARTHUR M. COMEY,
SAMUEL CABOT, ROBERT H. RICHARDS,
LEONARD P. KINNICUTT, HENRY P. TALBOT.
ARTHUR MICHAEL.

The Chair appointed the following standing committees: —

Committee of Publication.

SETH C. CHANDLER, of Class I., EDWARD L. MARK, of Class II.,
CRAWFORD H. TOY, of Class III.

Committee on the Library.

WILLIAM F. OSGOOD, of Class I., SAMUEL HENSHAW, of Class II.,
HENRY W. HAYNES, of Class III.

Auditing Committee.

HENRY G. DENNY, WILLIAM L. RICHARDSON.

The following gentlemen were elected members of the Academy: —

Charles Palache, of Cambridge, to be a Resident Fellow in Class II., Section 1 (Geology, Mineralogy, and Physics of the Globe).

William Francis Ganong, of Northampton, to be a Resident Fellow in Class II., Section 2 (Botany).

Charles R. Lanman gave an account of "The Completion of Whitney's Critical Commentary on the Atharva-Veda and the Continuity of Scientific Progress."

The following papers were presented by title: —

Contributions from the Gray Herbarium of Harvard University. New Series. No. XXVI. "New and otherwise Noteworthy Angiosperms from New Mexico and Central America." By J. M. Greenman. Presented by B. L. Robinson.

"Binary Families in a Triply Connected Region, with Especial Reference to Hypergeometric Families." By D. R. Curtiss. Presented by M. Bôcher.

"An Explanation of the False Spectra from Diffraction Gratings. By Theodore Lyman.

"Viscosity of Gases." By J. L. Hogg. Presented by John Trowbridge.

"The Spectra of Gases and Metals at High Temperatures." By John Trowbridge.

"The Changeable Hydrolytic Equilibrium of Dissolved Chromic Sulphate." By Theodore William Richards and Frederic Bonnet, Jr.

"The Anomalous Dispersion, Absorption, and Surface Color of Nitroso-dimethyl-aniline." By R. W. Wood. Presented by C. R. Cross.

On the motion of the Recording Secretary, the following resolution was unanimously adopted: —

Resolved, That the Fellows of the American Academy desire to place upon record their grateful appreciation of the services of their retiring President, Alexander Agassiz, during the nine years in which he has presided over their deliberations.

A TABLE OF ATOMIC WEIGHTS

OF SEVENTY-SEVEN ELEMENTS.

Compiled in April, 1902, from the most Recent Data.

BY THEODORE WILLIAM RICHARDS.

Name.	Symbol.	Atomic Weight.	Name.	Symbol.	Atomic Weight.
Aluminium	Al	27.1	Molybdenum	Mo	96.0
Antimony	Sb	120.0	Neodymium	Nd	143.6
Argon	A	39.92	Neon	Ne	19.94
Arsenic	As	75.0	Nickel	Ni	58.71
Barium	Ba	137.43	Niobium	Nb = Cb	94.
Beryllium	Be = Gl	9.1	Nitrogen	N	14.04
Bismuth	Bi	208.	Osmium	Os	190.8
Boron	B	11.0	Oxygen (standard)	O	16.000
Bromine	Br	79.955	Palladium	Pd	106.5
Cadmium	Cd	112.3	Phosphorus	P	31.0
Cæsium	Cs	132.88	Platinum	Pt	195.2
Calcium	Ca	40.13	Potassium	K	39.14
Carbon	C	12.001	Praseodymium	Pr	140.5
Cerium	Ce	140.	Rhodium	Rh	103.0
Chlorine	Cl	35.455	Rubidium	Rb	85.44
Chromium	Cr	52.14	Ruthenium	Ru	101.7
Cobalt	Co	59.00	Samarium ?	Sm	150.
Columbium	Cb = Nb	94.	Scandium	Sc	44.
Copper	Cu	63.60	Selenium	Se	79.2
"Didymium"	Nd + Pr	142.±	Silicon	Si	28.4
Erbium	Er	166.	Silver	Ag	107.93
Fluorine	F	19.05	Sodium	Na	23.05
Gadolinium	Gd	156. ?	Strontium	Sr	87.68
Gallium	Ga	70.0	Sulphur	S	32.065
Germanium	Ge	72.5	Tantalum	Ta	183.
Glucinum	Gl = Be	9.1	Tellurium	Te	127.5 ?
Gold	Au	197.3	Terbium ?	Tb	160.
Helium	He	3.96	Thallium	Tl	204.15
Hydrogen	H	1.0076	Thorium ?	Th	233. ?
Indium	In	114.	Thulium ?*	Tu	171. ?
Iodine	I	126.85	Tin	Sn	119.0
Iridium	Ir	193.0	Titanium	Ti	48.17
Iron	Fe	55.88	Tungsten	W	184.
Krypton	Kr	81.7	Uranium	U	238.5
Lanthanum	La	138.5	Vanadium	V	51.4
Lead	Pb	206.92	Xenon	X	128.
Lithium	Li	7.03	Ytterbium	Yb	173.
Magnesium	Mg	24.36	Yttrium	Yt	89.0
Manganese	Mn	55.02	Zinc	Zn	65.40
Mercury	Hg	200.0	Zirconium	Zr	90.6

NOTE.

THE accompanying table of atomic weights is but little changed since last year. Cæsium is made 132 88 instead of 132.9; calcium, 40.13 instead of 40.1; iron, 55.88 instead of 55.9; hydrogen, 1.0076 instead of 1.0075; and nickel, 58.71 instead of 56.70. The value for cæsium is due to some work, as yet unpublished, of Richards and Archibald, and that for calcium is increased in accuracy because the recent investigation of Hinrichsen * supports the less recent Harvard value.† The other very small changes are due simply to slight differences in the interpretation of data already well known. The decimal might have been omitted from palladium, because this element may still be a whole unit in doubt; but it has been retained as a compromise.

The differences between the present table, that of the German Committee,‡ and that of F. W. Clarke,§ are diminishing year by year. Nevertheless to as many as twenty-eight elements out of the seventy-seven are given values in these three tables differing among themselves by over one tenth of a per cent; namely, the atomic weights of antimony, bismuth, cerium, columbium, fluorine, gadolinium, germanium, helium, hydrogen, lanthanum, magnesium, mercury, neon, osmium, palladium, platinum, potassium, samarium, scandium, selenium, tantalum, tellurium, thorium, thulium, tin, titanium, uranium, and zirconium. To this list of uncertain elements should be added erbium, gallium, glucinum, indium, terbium, tungsten, ytterbium, upon which the three tables agree only because of lack of data upon which to base a disagreement. Thus nearly half of the elements are still in doubt by at least one part in a thousand. This circumstance is not so much a reproof to the many earnest workers upon the subject, as an evidence of the great difficulty of some of the problems involved.

Three of the elements given in the list above should not properly be included among the uncertain values, namely, hydrogen, magnesium, and potassium. The first finds its way into the list because of the disregard of significant figures by the German Committee, and the second chiefly because Clarke has included in his calculation work upon magnesic oxide undoubtedly erroneous on account of the presence of included gases. ‖ The case of potassium is somewhat peculiar; for in spite of the great wealth of data concerning this element, Clarke assigns to it the value 39.11, while the German Committee chooses 39.15. The low value is chiefly due to very unsatisfactory data concerning potassic iodide. To me it seems that the most recent work of Stas is far more satisfactory than his earlier work or than the work of any one else, hence the value 39.14 has been assigned to potassium in the present table since its first publication. Careful analyses by E. H. Archibald and myself confirm this conclusion.

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* Hinrichsen, Zeitschr. phys. Chem., **39**, 311 (1901).

† Richards, Journ. Am. Chem. Soc., **22**, 72 (1900), also **24**, 374 (1902).

‡ Landolt, Ostwald, and Seubert, Extra insertion in Berichte d. d. ch. Ges. 1902 Heft 1.

§ F. W. Clarke, Journ. Am. Chem. Soc., **24**, 201 (1902).

‖ Richards and Rogers, These Proceedings, **28**, 209 (1893).

AMERICAN ACADEMY OF ARTS AND SCIENCES.

REPORT OF THE COUNCIL. — PRESENTED MAY 13, 1903.

BIOGRAPHICAL NOTICES.

REPORT OF THE COUNCIL.

The Academy has lost seventeen members by death since the annual meeting of May 14, 1902: eight Resident Fellows, — William Sumner Appleton, James Elliot Cabot, Horace Gray, Henry Barker Hill, Charles Greely Loring, Henry Mitchell, John Daniel Runkle, Morrill Wyman; four Associate Fellows, — Josiah Willard Gibbs, John Wesley Powell, Ogden Nicholas Rood, Alfred Richard Cecil Selwyn; five Foreign Honorary Members, — Hervé Auguste Etienne Albans Faye, Gaston Bruno Paulin Paris, Sir George Gabriel Stokes, Bart., Rudolph Virchow, Heinrich von Wild.

ALPHEUS HYATT.

Our beloved and highly honored associate, who, in the ripeness of his intellectual powers, has been so suddenly snatched from us, was cast in no ordinary mould. Whether we regard him as a man, a patriot, a fellow student, a scientific investigator, an organizer of societies, of museums, or of methods of science-teaching, his many-sided life was a rare one. We come together to pay tribute to the memory of Alpheus Hyatt as a promoter of scientific enterprises, as one of the founders of a new school in the philosophy of biology, as a master in paleontological methods, endowed as he was with rare powers of mental absorption and concentration, and an unusual capacity for sound generalization.

The nineteenth century, as regards natural science in the United States of America, was a period of pioneer effort, and has been characterized by the careers of several great men. Their lives, unlike those of European savants, whose museums, laboratories, and methods of research had often been founded by a previous generation, had to be devoted, so to speak, to opening and laying out roads, to founding and building institutions, and making the way straight for the generations to come.

Such men were Henry, Dana, Agassiz, Wyman, Rogers, Hall, Baird, and others, all full of love for original research, but who unselfishly gave up much of their time, so dearly valued for private studies, to develop-

ing and expanding the educational and scientific resources of a young people.

Those who were pupils of that large-hearted, enthusiastic son of genius, Louis Agassiz, well know the sacrifices he made in the country of his adoption, in devoting the later years of his life to the foundation of the Museum of Comparative Zoölogy, to popularizing science, to illustrating the dignity of scientific studies, and enforcing the value of research in our colleges and young universities.

The lines thus drawn were followed by Hyatt; and it is safe to say that the impress he has made on zoölogical and geological science is deep and lasting.

Born in Washington, D. C., April 5, 1838, of Maryland parentage, Alpheus Hyatt was sent to the Maryland Military Academy, but afterwards entered Yale College, completing the freshman year, class of 1860. He then travelled a year in Europe, and as he once told us, strong family and clerical influence were brought to bear upon him while in Rome to induce him to enter the Church, his family being of the Roman Catholic faith.

He entered the Lawrence Scientific School in 1858; our acquaintance began in 1861. The pupils of Agassiz were then domiciled in Zoölogical Hall, a small two-story wooden building which stood on the site of the Peabody Museum of American Archaeology. We were soon interested and attracted by young Hyatt. Although he originally elected to make engineering his profession, he, with for that period a rather large number of other young men, was attracted by the fame and charming personality of Agassiz, as well as by the zoölogical treasures of the already rich and carefully selected museum. Hyatt's patience and his dogged perseverance, his powers of concentration, his philosophical tendencies, attracted our attention, while his open, frank, sunny disposition, his companionable, jovial, unselfish, pure spirit and scholarly aims, at once secured our love and respect. He was then and through life an all-round man, though very early in his studies specializing on the fossil Cephalopods.

Tyndall's "Heat as a Mode of Motion" had just appeared, and debates on the higher physics, in which he took a leading part, alternated with communications on the position of the Tunicata, of the Polyzoa, Brachiopods, and other types at the meetings of our Zoölogical Club. Hyatt was artistic in his tastes, drawing well on the blackboard, and handling the pencil with ease and facility. He read good literature, was a regular attendant on the lectures of Professor Lowell, and constantly present

at the courses of that model of scientific lecturers, Professor Jeffries Wyman.

He was graduated with high honors under Professor Agassiz in 1862. The Civil War was then raging, and the young patriot, having already received the elements of military training, enlisted, though naturally not without opposition from his family in Maryland, and was active in raising a company in Cambridge. He received a commission in 1862 as a lieutenant, but soon rose to the rank of captain in the Forty-seventh Massachusetts Regiment, serving as aide-de-camp nine months, for the most part in New Orleans.

After being mustered out of the army he lived in Boston some time during 1865-66, and it was then, and afterwards in Salem, that we came to know him still more intimately than at Cambridge, as we were at times room-mates. Over our friendship, our mutual love and respect, a cloud never passed. The purity and unaffected goodness, nobility of character, sturdy honesty and reliability as a friend, were as conspicuous then as in his last years. His filial devotion was marked, and in later life the kindness and chivalric courtesy, acts of kind-heartedness and thoughtfulness which in some instances it gave him some trouble to perform, to an elderly lady as well as to other friends in need, will be treasured up in our memory. Of his delightful domestic life, the warm-heartedness of his welcome to his hospitable home, his friends will ever retain the most agreeable recollections.

In the foundation and organization of scientific and educational enterprises, societies, journals, and museums, Hyatt always lent a willing hand. Gifted with a fair amount of executive ability, with clear, persuasive powers of expression, a ready debater, often a powerful speaker, and excellent in planning, besides having a somewhat wide knowledge of men, he was most useful in promoting such undertakings.

In 1867 he, with three other pupils of Agassiz, became one of the curators of the Essex Institute, and in 1869 he took an active and most useful part in the foundation of the Peabody Academy of Science at Salem, Mass., where he served as one of the curators.

As Custodian of the Boston Society of Natural History from 1870 to the end of his life, he planned an arrangement of the museum in accordance, so far as was possible, with the phylogeny of the animal kingdom, beginning with the Protozoa. He was one of the two founders of the Teachers' School of Science, becoming its manager, and in this way accomplished a vast amount of good in training the teachers of Boston and its vicinity in the elements of natural history. While living in Salem

he was one of the founders and editors of the "American Naturalist," contributing frequently to its pages.

The principal founder of the American Society of Naturalists, we well remember the zeal and interest he took in organizing this at present influential body, the preliminary meeting being held by a few at Springfield, Mass., in April, 1883. If we mistake not, he gave the name to the society. He was its first president, and a few years ago was elected an honorary member in recognition of his services.

He also founded and organized a seaside laboratory at Annisquam, Mass., under the auspices of the Woman's Education Association of Boston. He took personal charge of it, as his summer home was there. His interest in this school, and in marine zoölogy, led him to take part in the foundation of the Biological Laboratory at Wood's Holl. As an indication of the value of his services as an expert in zoölogy and his ability as an organizer, he was elected the first president of its board of trustees. He was elected a fellow of this Academy in 1869.

Throughout his life, after graduation at Harvard University, he was an honorary Assistant Curator in the Museum of Comparative Zoölogy, in charge of the collection of fossil Cephalopods. In 1888 he was offered the position of United States Commissioner of Fish and Fisheries, but preferred to live the almost ideal life, with its rich opportunities for research, which he rounded out at his home in Cambridge.

Professor Hyatt was not only a specialist, but a generalizer, a philosopher. His special, detailed, observational work was continually leading him to broad, sound generalizations, and not only in the field of embryology, taxonomy, and phylogeny, but of general organic evolution. He was a slow worker, very patient, cautious, constantly reviewing his work and conclusions. He was not always luminous in exposition; he sometimes, especially early in his life, failed from want of training and practice in writing, to state clearly and pointedly the views that crowded his mind. But this defect was largely outgrown. For this reason his first essay on "Parallelism," etc., was not understood by Mr. Darwin, as well as others who had not had experience in similar studies, but this defect of style was overcome in his later memoirs.

As the result of his manner of investigation, Hyatt became an acknowledged master in the methods of paleontology, in a mode of treatment of fossil forms then comparatively new to paleontology, due to his long and thorough training in zoölogy, comparative anatomy, and embryology. Before his time paleontologists, with the exception, of course, of Cuvier, Owen, Huxley, and Agassiz, had had but little training in anatomy and

taxonomy. Hyatt's patient and beautiful studies on the fresh water Polyzoa, carried on in the sixties; his later studies on the sponges, on the molluscs, other than Cephalopods; his experience as a teacher of zoölogy and paleontology in the Massachusetts Institute of Technology from 1870 to 1881, and of zoölogy in Boston University from 1877 to the time of his death, in addition to his museum work, kept him informed of biological methods and results; while his field work in the paleozoic rocks of southern Labrador, of Newfoundland, and his work about Salem, but more especially his work in 1889 and succeeding years as paleontologist in charge for the U. S. Geological Survey of the lower Mesozoic (Trias and Jura), carried on in Texas and in California, besides his earlier studies at Steinheim, Germany, afforded him the means of observing and accumulating many facts, and of forming broad conclusions from many points of view.

His prolonged and life-long studies on the Cephalopods were thorough and exhaustive, and from them were wrung the basal principles of evolution, — work which for thoroughness and far-reaching results has seldom been surpassed, and which not only is of the highest value and interest to students of molluscs, but has already exerted and will continue to exert a wide influence on the progress of general zoölogy.

The permanent fame of our deceased associate will, we venture to claim, be based on his contributions to the embryology, laws of growth of the shells, and the phylogeny of the Cephalopod molluscs; and on his profound studies on the modifications of the tertiary shells at Steinheim near Stuttgart, Germany.

He will also be remembered for his conclusions on the position of the sponges. As far as we are aware he was the first one after McAllister, in a paper published in 1876, entitled "Sponges considered as a distinct Sub-kingdom of Animals"* to refer these organisms to a separate, independent branch or phylum of the animal kingdom.

The outcome of these studies resulted in his valuable contributions to the philosophy of biology. He was one of the founders and upholders of Neolamarckism, and even if the value of that phase of the evolution theory be called in question, he will be remembered as having been the discoverer of a series of facts of astonishing number and variety, all converging to one grand result, that of affording a true, solid basis for the theory of organic evolution.

* Proceedings Boston Society of Natural History, XIX. Nov. 1, 1876. Hyatt claimed in this paper that during the previous year he regarded the sponges as distinct from the rest of the animal kingdom. l. c., p. 14. In this paper also, he rejected the position assigned them by Haeckel in the Coelenterata.

For a number of years Dr. Hyatt was engaged in a study of the origin and lines of evolution of the land shells peculiar to the Hawaiian Islands, on which the Rev. John T. Gulick had already (1887–1890) made such interesting and suggestive studies. Hyatt had presented several communications to scientific societies, showing the progress made in his work. His beautiful model of the islands, and arrangement of the actual shells fastened to the surface of the model, with cords of different colors showing the lines of migration and corresponding segregations and consequent differentiation of the specific forms, gave promise of the most valuable and fruitful results. He was planning to make a journey to the Hawaiian Islands in March of the present year, when death overtook him. But the results of his long continued labors will, it is hoped, not be lost to science, as arrangements were made previous to his death for their completion by a capable hand.

The first paper of a general nature which young Hyatt published * contained the germ of his chief life-work. It gave some of the results of six years' study on fossil Cephalopods, and was on the parallelism existing between the different stages of life in the individual and those of the tetrabranchiate Cephalopods as a group. It was published in 1866, the same year in which appeared Haeckel's "Generelle Morphologie," which, he (Haeckel) says, constituted the first attempt to apply the general doctrine of development to the whole range of organic morphology (anatomy and biogenesis). Although both of the Haeckelian principles of palingenesis and cenogenesis, with all their evolutional implications, were stated with considerable fullness by Fritz Müller in his "Für Darwin," published in 1864, Hyatt attempted to show that the life of the individual displays, to use his own words, "during its rise and decline, phenomena correlative with the rise and decline of the collective life of the group to which it immediately belongs." In this memoir he carried out and greatly amplified D'Orbigny's views, to which he gives the fullest credit, as to the changes of the larger number of Ammonites from larval, or to use his own term, nepionic, to adult, and from adult to senile stages. The theme, so often discussed by Agassiz before his students, that the development of the individual is an epitome of that of the order or class to which it belongs, with the later vital addition by F. Müller and by Haeckel of the evolution by actual descent, the principle now being

* "On the Parallelism between the Different Stages of Life in the Individual and those in the Entire Group of the Molluscous Order Tetrabranchiata." Memoirs Boston Soc. Nat. Hist., I. 1866.

called Haeckel's "biogenetic law," runs through and is the *motif* of Hyatt's life-long work.

Some of us in our maturer years return to or continue to work along the lines taken up in youth. Hyatt for a period of forty years, in a series of profound studies on the Cephalopods, in publications rich in exact observations and with ample illustrations, many of the drawings beautifully executed by his own hand, independently expanded and illustrated this fundamental phase of evolution, which so impressed him in his student days.

His remarkable memoir on the "Genesis of the Arietidae," published in 1889 in the Smithsonian "Contributions to Knowledge," and jointly with the Museum of Comparative Zoölogy, is a storehouse of facts on which his generalizations are based. When he presented his views to the National Academy of Science at a Washington meeting, Professor Henry expressed his approbation of the value and profoundity of this research. In this work he insists on his law of Morphogenesis, i. e., he attempts to demonstrate that "a natural classification may be made by means of a system of analysis in which the individual is the unit of comparison, because its life in all its phases, morphological and physiological, healthy or pathological, embryo, larva, adolescent, adult, and old (ontogeny), correlates with the morphological and physiological history of the group to which it belongs (phylogeny)."

In the beginning of his studies, contemporaneously with Cope, he insisted on the fact and results of a process of acceleration and retardation and the growth of the individual as well as the evolution of the family, order, or class of which it was a member.

"All modifications and variations," he says, "in progressive series tend to appear first in the adolescent or adult stages of growth, and then to be inherited in successive descendants at earlier and earlier stages according to the law of acceleration, until they either become embryonic, or are crowded out of the organization, and replaced in the development by characteristics of later origin."

Another of the nineteen conclusions prefacing this essay is No. 14: —

"The law of acceleration in development seems, therefore, to express an invariable mode of action of heredity, in the earlier reproduction of hereditary characteristics of all kinds and under all conditions. In progressive series it acts upon healthy characteristics, and appears to be an adaptation to favorable surroundings, and in retrogressive series upon pathological characteristics, and is probably an adaptation to unfavorable surroundings, usually leading to the extinction of the series or types."

This law of acceleration was, after the publication of Cope's and also of Hyatt's first paper (1870), arrived at independently by Würtenberger,* and adopted by the distinguished German paleontologist Neumayr, though he, apparently in ignorance of Hyatt's much earlier results, gives the credit for its discovery to Würtenberger, as does Weismann.

These changes Professor Hyatt insisted were primarily due to changes in the environment acting mechanically on the organism at different ages, the Lamarckian factors of use and disuse as well as environmental changes being constantly operative.

To explain the facts of retardation or abbreviated metamorphosis Dr. Hyatt formulates the law or process concerned in these phenomena, and which explain the mechanism of gradation, whether progressive or retrogressive, as follows: —

"Changes in environment, which introduce new adaptive characteristics in the nealogic or adult stages, necessarily add these to the hereditary stages of the younger periods of growth, and thus shorten the development of the latter by direct development." He goes on to illustrate this process by citing the changes of insects, of Taenia, and the loss of progressive characters correlated with a highly accelerated mode of development in man, due to a change from a horizontal to an upright position, and which, he says, were first pointed out nearly a century ago by Lamarck.

We will now, as briefly as the subject admits, trace the evolution of Professor Hyatt's views on evolution.

It has been objected to both Cope and Hyatt's theory that their law or process of acceleration and retardation are merely statements of facts. But both of these observers very soon after working out, each independently of the other, and in very different groups, these facts and processes, arrived at the conclusion that the changes they formulated were primarily due to the Lamarckian factors of change of environment, and to use and disuse.

They, with others of their contemporaries, rehabilitated and extended the Lamarckian factors and became the founders of the Neolamarckian school of evolutionists.

Hyatt's first public avowal of evolutional views was in a paper read in 1870,† though for several years he had practically adopted the theory

* Ausland, 1873.

† On Reversions among the Ammonites. Proc. Boston Soc. Nat. Hist., XIV. June, 1871.

of descent. His 1866 paper on "Parallelism," etc., was in this same vein of thought, but in this paper, conceived along evolutional lines, he did not explicitly state what were the actual dynamic agencies at work to produce the transformation from one form to another. His studies on the geological succession of the Ammonites, and the obvious genetic relations of the series he examined afterwards, naturally led him to adopt such views.

He claimed in this paper that the reversionary species he examined "all descended from one." In 1873 he showed that in the Ammonoids there are everywhere instances of the slow accumulation of differences, according with the Darwinian method, and of their quick and sudden production, "according to the law of acceleration as explained by Cope and the writer, and subsequently by Mivart." *

His Lamarckian leanings, however, so far as his published works show, crop out in his "Abstract of a Memoir on the Biological Relations of the Jurassic Ammonites." † The stages of growth he describes are here directly attributed to the favorable nature of the physical surroundings, primarily producing characteristic changes which become perpetuated and increased by inheritance within the groups. The production of retrogressive, senile forms he attributes to "the action of unfavorable surroundings." He carefully guards against "attributing the origin of these differences to the law of natural selection," limiting the action of this law "strictly to the modification of the structural differences which tend to appear first in the varieties and then by inheritance in larger and larger groups and at earlier and earlier stages in the life of the individual."

Hyatt's beautiful research on the problems suggested by the fossil pond-snails of Steinheim near Stuttgart, Germany, is an important contribution both to paleontology and to evolutional data. Hilgendorf had previously (in 1866) described the conditions, and his results were regarded in Germany as amounting to a demonstration of the truth of the evolution theory. Hyatt, during a year's residence in 1872 near Stuttgart, spent five weeks examining the pits and made careful collections.

The discussion is a most valuable contribution to the theory of descent. Sir Richard Owen wrote him in 1881: "I cannot say more than that I deem it a model of the way and aim in and by which such researches should be conducted in the present phase of Biology."

Hyatt's patient and long sustained studies led him to the following conclusions:

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* Proceedings Boston Soc. Nat. Hist., XVI. p. 167. Dec. 3, 1873.

† Ibid., XVII. pp. 236–241. Dec. 16, 1874.

1. The extraordinary modifications and series of shells found at Steinheim are in one way exceptional, and owe their existence to exceptional conditions.

2. These conditions appear to be the isolation of the modified descendants of *Planorbis laevis*, due to the absence of competing types and the character of the environment.

Besides other conclusions, he points out that in these and other series of animals which he had studied, "in a given number of generations inherited characteristics of every kind tend to appear in the descendants at earlier stages than that at which they first occurred in the ancestral forms."

These studies led him to explain the frequent occurrence of parallel forms, or, as they are now called, cases of convergence, also to examine into the causes of senescence, of geological extinction, etc. He maintained that there was no such thing as indefinite variation, and took strong ground, based on extended series of paleontological data, as to the reality of use-inheritance. In this as well as his other memoirs he insists on the inadequacy of natural selection in causing variation and the formation of new groups.

In a later work, entitled "Phylogeny of an Acquired Characteristic,"* Hyatt is at his best. The results of a life-long study of the genetic series of Cephalopods, of their rise, culmination, decay or senile features, and their final extinction, are portrayed in a masterly way. His conclusions are based on the careful detailed survey of a multitude of facts, and the story he unravels from the series upon series of fossil forms which passed in review before eyes so well trained, and a mind so skilled in induction and deduction, forms a chapter in the history of organic evolution which will remain a classic.

It was only after long years of research, and the most patient, thoughtful reflection on the series of facts he independently worked out, by his study of the embryology of the protoconch and conch of the Orthoceratites, and their successors the Nautiloids and Ammonoids, that he thus describes the gross results in a few sentences which show the mode of origin of new orders through the Lamarckian factors of effort and use. In this essay Hyatt struck the keynote to the cause of the origin of new types, or class and ordinal forms, i. e. by the changes in habits, and efforts of the organism to adapt itself to such new conditions of existence.

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* Phylogeny of an Acquired Characteristic. Proc. Amer. Phil. Soc., XXXII. p. 371 (1894).

These are the Lamarckian or dynamic agencies of use and disuse, brought into action by environmental changes.

"The *efforts*," he says, "of the Orthoceratite to adapt itself fully to the requirements of a mixed habitat of swimming and crawling gave rise to the Nautiloidea; the efforts of the same type to become completely a littoral crawler evolved the Ammonoidea. The successive forms of the Belemnoidea arose in the same way. But here the ground-swimming habitat and complete fitness for that was the object. The Sepioidea, on the other hand, represent the highest aims as well as the highest attainments of the Cephalopods in their evolution into surface-swimming and rapacious forms. We cannot seriously imagine these changes to have resulted from intelligent effort; but we can, with Lamarck and Cope, picture them as due to efforts on the part of the animal to take up new quarters in its environment and thus acquire habits and structures suitable to the changed physical requirements of its surroundings, and this position is better supported by facts than any other hypothesis."

Here are some examples of the complete and thoroughgoing way in which Hyatt thought out, during his painfully slow but sure investigation of facts, broad generalizations which we feel confident will stand the test of time and farther research.

After speaking of "the effort to change of habitat and consequently change of habits," due to change of environment, and of changes in structure resulting from the efforts on the part of the organism to meet the changes in the physical surroundings, he adds: "That this process should end in the production of structures suited to the environment is inevitable. *With these factors at work, both without and within the organism, the evolution of their structures obeys a physical law which acts amid a thousand disturbing forces, perhaps, but nevertheless must act with predominating force in one mean path or direction, the resultant determined by the environment and the inherited structures of the organism.*"

Another beautiful research was his attempt to account by gravity for the spiral shell of molluscs. He points out the fact of an obvious correlation between the coiling of the shell and the habit of crawling. He shows that those gastropod shells which degenerate and tend to lose the spiral mode of growth and become irregularly straightened out in their older stages of growth, are forms which become attached or which lead sedentary lives, i. e. Vermetus attached late in life, and Magilus which lives buried in coral. He points out the tendency in the descendants of straight shells (Orthoceratites, etc.) to become, as the result of assuming

reptant habits, first arcuate and then coiled; these being acquired characters which have been "introduced late in the ontogeny and gradually forced back to younger and younger stages in successive generations, or species, or genera." He also accounts for the peculiar horizontal growth of the oyster, pecten, etc., by their fixed mode of life.

These observations, modes of investigations, and laws or principles so carefully thought out, are the work of a master in biology. They already have been most fruitful in their results, and have been found to apply in other groups of organized beings. Hyatt was thus the founder of a new school in paleontology, and the brilliant results of the work of a younger generation of paleontologists, viz., Beecher, Jackson, Suchert, Smith, and others, all of whom acknowledge him as their master, afford the best of proof of our claim. Certainly the same principles we think will apply to Crustacea, and also to insects, as Hyatt has claimed, and they were applied to vertebrates by Cope and his successors in vertebrate paleontology. For all this work Hyatt's name will forever be associated with the names of Agassiz, Barrande, Neumayr, Waagen, Mojsisovics, and others who have worked along these lines.

Hyatt's systematic work on the Cephalopods was very extensive. It will be remembered that there are estimated to be about twenty-five hundred species of Nautiloids and five thousand species of Ammonoids. The results of his labors may be seen in the portion he contributed to the translation by Dr. Eastman of the condensed American edition of Zittel's Paleontology.

In systematic work on the Ammonites Hyatt followed hard after Suess, who in 1865 inaugurated the subdivision of the group into genera. As stated by Zittel:* "A similar reform was advocated by Alpheus Hyatt in his memoir on the Liassic Ammonites (1869). The previous nomenclature of families was discarded by Hyatt, and numerous new genera were erected, whose limits were much more narrowly defined than had been customary. As one might have expected, the new tendency met at first with strong opposition, but it was supported and followed by Laube, Zittel, Mojsisovics, Waagen, and Neumayr."

Dr. Hyatt was not a voluminous writer, but his works are solid, original, independent contributions to science, and will stand, if we mistake not, the test of time.

He was elected a member of the National Academy of Science in 1875, and since 1897 has been a corresponding member of the Geological

* Zittel's History of Geology and Palaeontology. Translated by M. M. Ogilvie-Gordon. 1891. p. 403.

Society of London. In 1898 he received from Brown University the degree of Doctor of Laws. At the time of his death (Feb. 15, 1902) he was the Vice-president of Class II. of this Academy.

Endowed by nature with talents of a high order, he cultivated and, to use his own favorite phrase, accelerated their development and increase through his life. His strength of character is evinced by the forceful influence he exerted both in scientific and educational channels.

"*Talent*," says Baron Osten Sacken, the venerable diplomatist and naturalist, "is a gift of nature, and does not, for that reason, constitute in itself a merit; the merit lies in the *character* which makes talent fruitful." And that profound genius and master in biology — Von Baer — has said: "In the domain of Science, talent alone, coupled with diligence and *the power of self-control*, is of any value." *

We close this notice of our departed friend, who endeared himself to his associates so closely by his amiable and manly qualities, feeling sure that posterity will confirm the estimate here given of his worth as a man, and of the secure place he will hold as a master in science.

A. S. PACKARD.

JOHN DANIEL RUNKLE.

JOHN DANIEL RUNKLE was born at Root, N. Y., October 11, 1822, and died at Southwest Harbor, Me., July 8, 1902, near the close of his eightieth year.

The early years of life on the farm offered little opportunity for study, and he was already twenty-five when he entered the newly established Lawrence Scientific School of Harvard University. His name stands alone in the catalogue of 1848–49 as "student in mathematics." John W. Draper and James E. Oliver were fellow students; Josiah P. Cooke and William T. Harris, resident graduates. He was a member of the first graduating class, of 1851, with Joseph Le Conte and David A. Wells, receiving the degree of Bachelor of Science, and at the same time, for high scholarship, the honorary degree of Master of Arts.

The work of computation for the Nautical Almanac was carried on at this time in Cambridge by a staff including, among other men of subsequent eminence, Simon Newcomb, Asaph Hall, George W. Hill, T. H.

* Quoted from "An Introduction to the Record of my Life-work in Entomology." By C. R. Von Osten Sacken. 1901.

Safford, and J. M. Van Vleck. Mr. Runkle's connection with the Almanac began in 1849, and continued in some form as late as 1884.

In 1852 he contributed to the "Astronomical Journal" papers on the "Elements of Thetis" and on the "Elements of Psyche."

In 1855 his "New tables for determining the values of the coefficients, in the perturbative function of planetary motion, which depend upon the ratio of the mean distances," were published as one of the Smithsonian Contributions to Knowledge.

In 1858 Mr. Runkle founded the "Mathematical Monthly." Encouragement was received and formal indorsement given by the American Association for the Advancement of Science and by several educational bodies. The list of contributors included many distinguished names, among others Arthur Cayley, William Chauvenet, George W. Hill, Simon Newcomb, Benjamin Pierce, John Herschel. The time for the publication of a long-lived mathematical journal was not, however, ripe, and only three volumes appeared.

From 1860 until his death Professor Runkle's time and strength were almost continuously and exclusively devoted to the establishment and upbuilding of the Massachusetts Institute of Technology. He was first Secretary of the Institute, and at the opening of the school became professor of mathematics. In October, 1868, he became Acting President in consequence of President Rogers' serious illness, and in 1870 he was made President, holding the office for the following eight years.

The situation was a most exacting one, making altogether exceptional demands. The school, only five years old, was in no condition to lose the guidance of its founder. It had not yet gathered the momentum necessary for steady, straightforward progress. Opinions did and will differ as to President Runkle's judgment on the difficult questions that, as time passed, pressed overwhelmingly upon him for solution. No man could have been more devotedly loyal to the school or to its founder, his predecessor and ultimately his successor. None could have shown more steadfast courage, not only against heavy odds, but too often with but feeble support.

The more notable events of the Runkle presidency were: the fruitless negotiations with Harvard University for a union; the establishment of the laboratories of mining engineering and metallurgy; the introduction of shop instruction and the foundation of the School of Mechanic Arts; the development of professional summer schools in the field; the beginnings of an engineering laboratory; the increased efficiency of military instruction and the summer encampment at Philadelphia in 1876; the

erection of a gymnasium, including a lunch-room; the admission of women as students.

In 1878 Dr. Runkle resigned the presidency of the Institute and spent the following two years in Europe.

It had been President Runkle's merit to be the first to appreciate the American need of mechanic arts instruction based on principles already successfully applied in Russia. He was primarily interested in it as an invaluable addition to existing engineering courses, but he also saw clearly its great potential significance for general secondary education, and so far as possible, under pressure of other needs, demonstrated this by the inauguration of the School of Mechanic Arts, in which boys of high-school age were offered a two years' course, including mathematics, English, French, history, mechanical and freehand drawing, and shop-work. His visit to Europe enabled him to make a study of Continental schools of similar purpose; and the results of this study are embodied in a paper presented to the Society of Arts in April, 1881, on "Technical and Industrial Education Abroad," in an extended contribution to the Report of the Massachusetts Board of Education for 1880–81, and in a "Report on Industrial Education" in 1884. Others have taken a more directly prominent share in the introduction and extension of mechanic arts or manual training in primary and secondary schools, but the actual experiment initiated by him in Boston had in its time wide influence and imitation.

As a teacher of mathematics, Professor Runkle found his highest usefulness and most congenial vocation, — a vocation to be happily continued for not less than twenty-one years. His teaching was characterized by stimulating, luminous, unconventional exposition, by quick incisive questioning, by warm personal interest in his students, and by a constant substratum of uplifting earnestness and dignity. None of his students could fail to acquire admiring affection; very few could withstand the incentive to work.

Professor Runkle was a man of much intellectual quickness and strength, of ardent, but in later years serene, temperament, of warm and generous affections, of cordial, unaffected courtesy, in all the relations of life a sincere and loyal gentleman. Throughout his early and middle life he was a pioneer, first in the struggle for his own education and that of his brothers, next in the establishment and continuance of a much-needed, but, as it turned out, premature mathematical journal, then and for many years in the development of the Massachusetts Institute of Technology, and the introduction of education in the mechanic arts. In

all these undertakings his insight and courage were invaluable. He made President Rogers' plans for the Institute his own. He held steadfastly to its fundamental ideals, and, taking account of his scanty resources, made remarkable progress toward their fulfilment. The main changes he initiated have been abundantly justified by time, and he lived to see their fulfilment.

He was elected a Fellow of the Academy on the 26th of May, 1857, and served one year (1877–78) as Councillor.

New members elected are: Resident Fellows, 6; Associate Fellows, 3; Foreign Honorary Members, 5. The roll of the Academy now includes 197 Resident Fellows, 98 Associate Fellows, and 72 Foreign Honorary Members.*

* By the resignation of a Resident Fellow, the death of an Associate Fellow and a Foreign Honorary Member, and the election of new members at the annual meeting of May 13, 1903, the roll stands at date of publication, 198 Resident Fellows, 98 Associate Fellows, 72 Foreign Honorary Members.

American Academy of Arts and Sciences.

OFFICERS AND COMMITTEES FOR 1903-04.

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VICE-PRESIDENT.

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JOHN TROWBRIDGE,	HENRY P. WALCOTT,	JOHN C. GRAY.

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WILLIAM M. DAVIS.

RECORDING SECRETARY

WILLIAM WATSON.

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FRANCIS BLAKE.

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Class I.	Class II.	Class III.
GEORGE F. SWAIN,	ROBERT DE C. WARD, *Terms expire* 1904.	DENMAN W. ROSS,
ARTHUR G. WEBSTER,	EDWARD L. MARK, *Terms expire* 1905.	ARLO BATES,
LEWIS J. JOHNSON,	EDWARD H. BRADFORD, *Terms expire* 1906.	MORRIS H. MORGAN,

COMMITTEE OF FINANCE.

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SETH C. CHANDLER, of Class I., CRAWFORD H. TOY, of Class III.

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AUDITING COMMITTEE.

HENRY G. DENNY, WILLIAM L. RICHARDSON.

LIST

OF THE

FELLOWS AND FOREIGN HONORARY MEMBERS.

(Corrected to June 30, 1903.)

RESIDENT FELLOWS. — 198.

(Number limited to two hundred.)

CLASS I. — *Mathematical and Physical Sciences.* — 81.

SECTION I. — 18.

Mathematics and Astronomy.

Solon I. Bailey,	Cambridge.
Maxime Bôcher,	Cambridge.
William E. Byerly,	Cambridge.
Seth C. Chandler,	Cambridge.
Gustavus Hay,	Boston.
Percival Lowell,	Boston.
James Mills Peirce,	Cambridge.
Edward C. Pickering,	Cambridge.
William H. Pickering,	Cambridge.
Henry S. Pritchett,	Boston.
John Ritchie, Jr.,	Roxbury.
Edwin F. Sawyer,	Brighton.
Arthur Searle,	Cambridge.
William E. Story,	Worcester.
Henry Taber,	Worcester.
Harry W. Tyler,	Boston.
O. C. Wendell,	Cambridge.
P. S. Yendell,	Dorchester.

SECTION II. — 24.

Physics.

A. Graham Bell,	Washington, D.C.
Clarence J. Blake,	Boston.
Francis Blake,	Weston.
George A. Campbell,	Boston.
Harry E. Clifford,	Newton.
Charles R. Cross,	Brookline.
Amos E. Dolbear,	Somerville.
A. W. Duff,	Worcester.
H. M. Goodwin,	Roxbury.
Edwin H. Hall,	Cambridge.
Hammond V. Hayes,	Cambridge.
William L. Hooper,	Somerville.
William W. Jacques,	Newton.
Frank A. Laws,	Boston.
Henry Lefavour,	Boston.
Theodore Lyman,	Brookline.
Benjamin O. Peirce,	Cambridge.
A. Lawrence Rotch,	Boston.
Wallace C. Sabine,	Boston.
John S. Stone,	Boston.
Elihu Thomson,	Swampscott.
John Trowbridge,	Cambridge.
A. G. Webster,	Worcester.
Robert W. Willson,	Cambridge.

SECTION III. — 21.

Chemistry.

Samuel Cabot,	Boston.

Arthur M. Comey,	Cambridge.
James M. Crafts,	Boston.
Charles W. Eliot,	Cambridge.
Charles L. Jackson,	Cambridge.
Walter L. Jennings,	Worcester.
Leonard P. Kinnicutt,	Worcester.
Charles F. Mabery,	Cleveland, O.
Arthur Michael,	Boston.
George D. Moore,	Worcester.
Charles E. Munroe,	Wash'gton, D.C.
John U. Nef,	Chicago, Ill.
Arthur A. Noyes,	Boston.
Robert H. Richards,	Jamaica Plain.
Theodore W. Richards,	Cambridge.
Charles R. Sanger,	Cambridge.
Stephen P. Sharples,	Cambridge.
Francis H. Storer,	Boston.
Henry P. Talbot,	Newton.
Charles H. Wing,	Ledger, N. C.
Edward S. Wood,	Boston.

SECTION IV. — 18.

Technology and Engineering.

Alfred E. Burton,	Boston.
Eliot C. Clarke,	Boston.
Heinrich O. Hofman,	Jamaica Plain.
Ira N. Hollis,	Cambridge.
L. J. Johnson,	Cambridge.
Gaetano Lanza,	Boston.
E. D. Leavitt,	Cambridge.
William R. Livermore,	New York.
Hiram F. Mills,	Lowell.
Cecil H. Peabody,	Brookline.
Alfred P. Rockwell,	Manchester.
Andrew H. Russell,	Manila.
Albert Sauveur,	Cambridge.
Peter Schwamb,	Arlington.
H. L. Smyth,	Cambridge.
Charles S. Storrow,	Boston.
George F. Swain,	Boston.
William Watson,	Boston.

CLASS II. — *Natural and Physiological Sciences.* — 68.

SECTION I. — 15.

Geology, Mineralogy, and Physics of the Globe.

H. H. Clayton,	Milton.
Algernon Coolidge,	Boston.
William O. Crosby,	Jamaica Plain.
William M. Davis,	Cambridge.
Benj. K. Emerson,	Amherst.
O. W. Huntington,	Newport, R. I.
Robert T. Jackson,	Cambridge.
T. A. Jaggar, Jr.,	Cambridge.
William H. Niles,	Cambridge.
Charles Palache,	Cambridge.
John E. Pillsbury,	Boston.
Nathaniel S. Shaler,	Cambridge.
Robert DeC. Ward,	Cambridge.
John E. Wolff,	Cambridge.
J. B. Woodworth,	Cambridge.

SECTION II. — 12.

Botany.

F. S. Collins,	Malden.
Geo. E. Davenport,	Medford.
William G. Farlow,	Cambridge.
Charles E. Faxon,	Jamaica Plain.
Merritt L. Fernald,	Cambridge.
William F. Ganong,	Northampton.
George L. Goodale,	Cambridge.
John G. Jack,	Jamaica Plain.
B. L. Robinson,	Cambridge.
Charles S. Sargent,	Brookline.
Arthur B. Seymour,	Cambridge.
Roland Thaxter,	Cambridge.

SECTION III. — 25.

Zoölogy and Physiology.

Alexander Agassiz,	Cambridge.
Robert Amory,	Boston.

James M. Barnard,	Milton.
Henry P. Bowditch,	Jamaica Plain.
William Brewster,	Cambridge.
Louis Cabot,	Brookline.
William E. Castle,	Cambridge.
Samuel F. Clarke,	Williamstown.
W. T. Councilman,	Boston.
Charles B. Davenport,	Chicago, Ill.
Harold C. Ernst,	Jamaica Plain.
Edward G. Gardiner,	Boston.
Samuel Henshaw,	Cambridge.
Theodore Hough,	Boston.
John S. Kingsley,	Somerville.
Edward L. Mark,	Cambridge.
Charles S. Minot,	Milton.
Edward S. Morse,	Salem.
George H. Parker,	Cambridge.
William T. Porter,	Boston.
James J. Putnam,	Boston.
Samuel H. Scudder,	Cambridge.
William T. Sedgwick,	Boston.
James C. White,	Boston.
William M. Woodworth,	Cambridge.

SECTION IV. — 16.

Medicine and Surgery.

Samuel L. Abbot,	Boston.
Edward H. Bradford,	Boston.
Arthur T. Cabot,	Boston.
David W. Cheever,	Boston.
Frank W. Draper,	Boston.
Thomas Dwight,	Nahant.
Reginald H. Fitz,	Boston.
Charles F. Folsom,	Boston.
Frederick I. Knight,	Boston.
Samuel J. Mixter,	Boston.
W. L. Richardson,	Boston.
Theobald Smith,	Jamaica Plain.
O. F. Wadsworth,	Boston.
Henry P. Walcott,	Cambridge.
John C. Warren,	Boston.
Francis H. Williams,	Boston.

CLASS III. — *Moral and Political Sciences.* — 49.

SECTION I. — 10.

Philosophy and Jurisprudence.

James B. Ames,	Cambridge.
John C. Gray,	Boston.
G. Stanley Hall,	Worcester.
Geo. F. Hoar,	Worcester.
Francis C. Lowell,	Boston.
Hugo Münsterberg,	Cambridge.
Josiah Royce,	Cambridge.
Jeremiah Smith,	Cambridge.
Frederic J. Stimson,	Dedham.
Edward H. Strobel,	Cambridge.

SECTION II. — 20.

Philology and Archæology.

Charles P. Bowditch,	Jamaica Plain.
Lucien Carr,	Cambridge.
Franklin Carter,	Williamstown.
Joseph T. Clarke,	Boston.
Henry G. Denny,	Roxbury.
William Everett,	Quincy.
J. W. Fewkes,	Washington, D.C.
William W. Goodwin,	Cambridge.
Henry W. Haynes,	Boston.
Charles R. Lanman,	Cambridge.
David G. Lyon,	Cambridge.
Morris H. Morgan,	Cambridge.
Bennett H. Nash,	Boston.
Frederick W. Putnam,	Cambridge.
Edward Robinson,	Boston.
F. B. Stephenson,	Boston.
Crawford H. Toy,	Cambridge.
John W. White,	Cambridge.
John H. Wright,	Cambridge.
Edward J. Young,	Waltham.

SECTION III. — 10.

Political Economy and History.

Charles F. Adams,	Lincoln.
Edward Atkinson,	Brookline.
Andrew McF. Davis,	Cambridge.
Ephraim Emerton,	Cambridge.
A. C. Goodell,	Salem.
Henry C. Lodge,	Nahant.
A. Lawrence Lowell,	Boston.
James F. Rhodes,	Boston.
Charles C. Smith,	Boston.
F. W. Taussig,	Cambridge.

SECTION IV. — 9.

Literature and the Fine Arts.

Francis Bartlett,	Boston.
John Bartlett,	Cambridge.
Arlo Bates,	Boston.
George S. Boutwell,	Groton.
T. W. Higginson,	Cambridge.
George L. Kittredge,	Cambridge.
Charles Eliot Norton,	Cambridge.
Denman W. Ross,	Cambridge.
Barrett Wendell,	Boston.

ASSOCIATE FELLOWS. — 98.

(Number limited to one hundred. Elected as vacancies occur.)

Class I. — *Mathematical and Physical Sciences.* — 36.

Section I. — 14.

Mathematics and Astronomy.

Edward E. Barnard,	Williams Bay,
S. W. Burnham,	Chicago. [Wis.
George Davidson,	San Francisco.
Fabian Franklin,	Baltimore.
Asaph Hall,	Goshen, Conn.
George W. Hill,	W. Nyack, N.Y.
E. S. Holden,	New York.
Emory McClintock,	Morristown, N.J.
E. H. Moore,	Chicago.
Simon Newcomb,	Washington.
Charles L. Poor,	New York.
George M. Searle,	Washington.
J. N. Stockwell,	Cleveland, O.
Chas. A. Young,	Princeton, N. J.

Section II. — 6.

Physics.

Carl Barus,	Providence, R.I.
G. E. Hale,	Williams Bay, Wis.
S. P. Langley,	Washington.
T. C. Mendenhall,	
A. A. Michelson,	Chicago.
E. L. Nichols,	Ithaca, N. Y.

Section III. — 8.

Chemistry.

T. M. Drown,	So. Bethlehem, Pa.
Wolcott Gibbs,	Newport, R.I.
Frank A. Gooch,	New Haven.
S. W. Johnson,	New Haven.
J. W. Mallet,	Charlottesville, Va.
E. W. Morley,	Cleveland, O.
J. M. Ordway,	New Orleans.
Ira Remsen,	Baltimore.

Section IV. — 8.

Technology and Engineering.

Henry L. Abbot,	Cambridge.
Cyrus B. Comstock,	New York. [Va.
W. P. Craighill,	Charlestown, W.
John Fritz,	Bethlehem, Pa.
F. R. Hutton,	New York.
George S. Morison,	New York.
William Sellers,	Edge Moor, Del.
Robt. S. Woodward,	New York.

Class II. — *Natural and Physiological Sciences.* — 31.

Section I. — 10.

Geology, Mineralogy, and Physics of the Globe.

Cleveland Abbe,	Washington.
George J. Brush,	New Haven.
T. C. Chamberlin,	Chicago.
Edward S. Dana,	New Haven.
Walter G. Davis,	Cordova, Arg.
Samuel F. Emmons,	Washington.
G. K. Gilbert,	Washington.
S. L. Penfield,	New Haven.
R. Pumpelly,	Newport, R.I.
Charles D. Walcott,	Washington.

SECTION II. — 6.

Botany.

L. H. Bailey,	Ithaca, N. Y.
D. H. Campbell,	Palo Alto, Cal.
J. M. Coulter,	Chicago.
C. G. Pringle,	Charlotte, Vt.
John D. Smith,	Baltimore.
W. Trelease,	St. Louis.

SECTION III. — 9.

Zoölogy and Physiology.

Joel A. Allen,	New York.
W. K. Brooks,	Lake Roland, Md.
F. P. Mall,	Baltimore.
S. Weir Mitchell,	Philadelphia.
H. F. Osborn,	New York.
A. S. Packard,	Providence, R.I.
A. E. Verrill,	New Haven.
C. O. Whitman,	Chicago.
E. B. Wilson,	New York.

SECTION IV. — 6.

Medicine and Surgery.

John S. Billings,	New York.
W. S. Halsted,	Baltimore.
W. W. Keen,	Philadelphia.
William Osler,	Baltimore.
Wm. H. Welch,	Baltimore.
H. C. Wood,	Philadelphia.

CLASS III. — *Moral and Political Sciences.* — 31.

SECTION I. — 7.

Philosophy and Jurisprudence.

James C. Carter,	New York.
Joseph H. Choate,	New York.
Melville W. Fuller,	Washington.
William W. Howe,	New Orleans.
Charles S. Peirce,	Milford, Pa.
G. W. Pepper,	Philadelphia.
T. R. Pynchon,	Hartford, Conn.

SECTION II. — 7.

Philology and Archæology.

Timothy Dwight,	New Haven.
B. L. Gildersleeve,	Baltimore.
D. C. Gilman,	Baltimore.
T. R. Lounsbury,	New Haven.
Rufus B. Richardson,	Athens.
Thomas D. Seymour,	New Haven.
A. D. White,	Ithaca, N.Y.

SECTION III. — 8.

Political Economy and History.

Henry Adams,	Washington.
G. P. Fisher,	New Haven.
Arthur T. Hadley,	New Haven.
H. E. von Holst,	Chicago.
Henry C. Lea,	Philadelphia.
Alfred T. Mahan,	New York.
H. Morse Stephens,	Ithaca.
W. G. Sumner,	New Haven.

SECTION IV. — 9.

Literature and the Fine Arts.

James B. Angell,	Ann Arbor, Mich.
L. P. di Cesnola,	New York.
H. H. Furness,	Wallingford, Pa.
R. S. Greenough,	Florence.
Herbert Putnam,	Washington.
Augustus St. Gaudens,	Windsor, Vt.
John S. Sargent,	London.
E. C. Stedman,	Bronxville, N. Y.
W. R. Ware,	New York.

FOREIGN HONORARY MEMBERS. — 72.

(Number limited to seventy-five. Elected as vacancies occur.)

Class I. — *Mathematical and Physical Sciences.* — 23.

Section I. — 7.

Mathematics and Astronomy.

Arthur Auwers,	Berlin.
Luigi Cremona,	Rome.
George H. Darwin,	Cambridge.
Sir William Huggins,	London.
H. Poincaré,	Paris.
Otto Struve,	Karlsruhe.
H. C. Vogel,	Potsdam.

Section II. — 5.

Physics.

Ludwig Boltzmann,	Leipsic.
Oliver Heaviside,	Newton Abbot.
F. Kohlrausch,	Berlin.
Lord Rayleigh,	Witham.
Joseph J. Thomson,	Cambridge.

Section III. — 6.

Chemistry.

Adolf Ritter von Baeyer,	Munich.
Marcellin Berthelot,	Paris.
J. H. van't Hoff,	Berlin.
D. Mendeleeff,	St. Petersburg.
Sir H. E. Roscoe,	London.
Julius Thomsen,	Copenhagen.

Section IV. — 5.

Technology and Engineering.

Sir Benjamin Baker,	London.
Lord Kelvin,	Largs.
Maurice Lévy,	Paris.
H. Müller-Breslau,	Berlin.
W. Cawthorne Unwin,	London.

Class II. — *Natural and Physiological Sciences.* — 26.

Section I. — 7.

Geology, Mineralogy, and Physics of the Globe.

Sir Archibald Geikie,	London.
Julius Hann,	Vienna.
Albert Heim,	Zurich.
Sir John Murray,	Edinburgh.
Freih. v. Richthofen,	Berlin.
Henry C. Sorby,	Sheffield.
K. A. Ritter von Zittel,	Munich.

Section II. — 6.

Botany.

E. Bornet,	Paris.
A. Engler,	Berlin.
Sir Joseph D. Hooker,	Sunningdale.
W. Pfeffer,	Leipsic.
H. Graf zu Solms-Laubach,	Strassburg.
Eduard Strasburger,	Bonn.

SECTION III.—6.

Zoölogy and Physiology.

Sir Michael Foster,	Cambridge.
Ludimar Hermann,	Königsberg.
A. von Kölliker,	Würzburg.
H. Kronecker,	Bern.
E. Ray Lankester,	London.
Elias Metschnikoff,	Paris.

SECTION IV.—7.

Medicine and Surgery.

Emil von Behring,	Marburg.
Sir T. L. Brunton,	London.
A. Celli,	Rome.
Sir V. A. H. Horsley,	London.
R. Koch,	Berlin.
Lord Lister,	London.
F. v. Recklinghausen,	Strassburg.

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SECTION I.—5.

Philosophy and Jurisprudence.

A. J. Balfour,	Prestonkirk.
Heinrich Brunner,	Berlin.
A. V. Dicey,	Oxford.
F. W. Maitland,	Cambridge.
Sir Frederick Pollock, Bart.,	London.

SECTION II.—7.

Philology and Archæology.

Ingram Bywater,	Oxford.
F. Delitzsch,	Berlin.
W. Dörpfeld,	Athens.
Sir John Evans,	Hemel Hempstead.
H. Jackson,	Cambridge.
J. W. A. Kirchhoff,	Berlin.
G. C. C. Maspero,	Paris.

SECTION III.—5.

Political Economy and History.

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Theodor Mommsen,	Berlin.
Sir G. O. Trevelyan, Bart.,	London.
W. E. H. Lecky,	London.
John Morley,	London.

SECTION IV.—6.

Literature and the Fine Arts.

E. de Amicis,	Florence.
Georg Brandes,	Copenhagen.
F. Brunetière,	Paris.
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Sir Leslie Stephen,	London.

STATUTES AND STANDING VOTES.

STATUTES.

Adopted May 30, 1854: *amended September* 8, 1857, *November* 12, 1862, *May* 24, 1864, *November* 9, 1870, *May* 27, 1873, *January* 26, 1876, *June* 16, 1886, *October* 8, 1890, *January* 11 *and May* 10, 1893, *May* 9 *and October* 10, 1894, *March* 13, April 10 *and May* 8, 1895, *May* 8, 1901, *and January* 8, 1902.

CHAPTER I.

Of Fellows and Foreign Honorary Members.

1. The Academy consists of Resident Fellows, Associate Fellows and Foreign Honorary Members. They are arranged in three Classes, according to the Arts and Sciences in which they are severally proficient, viz.: Class I. The Mathematical and Physical Sciences; — Class II. The Natural and Physiological Sciences; — Class III. The Moral and Political Sciences. Each Class is divided into four Sections, viz.: Class I., Section 1. Mathematics and Astronomy; — Section 2. Physics; — Section 3. Chemistry; — Section 4. Technology and Engineering. Class II., Section 1. Geology, Mineralogy, and Physics of the Globe; — Section 2. Botany; — Section 3. Zoölogy and Physiology; — Section 4. Medicine and Surgery. Class III., Section 1. Philosophy and Jurisprudence: — Section 2. Philology and Archæology; — Section 3. Political Economy and History; — Section 4. Literature and the Fine Arts.

2. The number of Resident Fellows shall not exceed two hundred. Only residents in the Commonwealth of Massachusetts shall be eligible to election as Resident Fellows, but resident fellowship may be retained after removal from the Commonwealth. Each Resident Fellow shall pay an admission fee of ten dollars and such annual assessment, not exceeding ten dollars, as shall be voted by the Academy at each annual

meeting. Resident Fellows only may vote at the meetings of the Academy.

3. The number of Associate Fellows shall not exceed one hundred, of whom there shall not be more than forty in either of the three classes of the Academy. Associate Fellows shall be chosen from persons residing outside of the Commonwealth of Massachusetts. They shall not be liable to the payment of any fees or annual dues, but on removing within the Commonwealth they may be transferred by the Council to resident fellowship as vacancies there occur.

4. The number of Foreign Honorary Members shall not exceed seventy-five; and they shall be chosen from among persons most eminent in foreign countries for their discoveries and attainments in either of the three departments of knowledge above enumerated. There shall not be more than thirty Foreign Members in either of these departments.

CHAPTER II.

Of Officers.

1. There shall be a President, three Vice-Presidents, one for each Class, a Corresponding Secretary, a Recording Secretary, a Treasurer, and a Librarian, which officers shall be annually elected, by ballot, at the Annual Meeting, on the second Wednesday in May.

2. At the Annual Meeting of 1901, nine Councillors shall be elected by ballot, one from each Class of the Academy to serve for one year, one from each Class for two years, and one from each Class for three years; and at annual meetings thereafter three Councillors shall be elected in the same manner, one from each Class, to serve for three years; but the same Fellow shall not be eligible for two successive terms. The nine Councillors, with the President, the three Vice-Presidents, the two Secretaries, the Treasurer, and the Librarian, shall constitute the Council. Five members shall constitute a quorum. It shall be the duty of this Council to exercise a discreet supervision over all nominations and elections. With the consent of the Fellow interested, they shall have power to make transfers between the several Sections of the same Class, reporting their action to the Academy.

3. If any office shall become vacant during the year, the vacancy shall be filled by a new election, and at the next stated meeting, or at a meeting called for this purpose.

CHAPTER III.

Of Nominations of Officers.

1. At the stated meeting in March, the President shall appoint from the next retiring Councillors a Nominating Committee of three Fellows, one for each class.

2. It shall be the duty of this Nominating Committee to prepare a list of candidates for the offices of President, Vice-Presidents, Corresponding Secretary, Recording Secretary, Treasurer, Librarian, Councillors, and the Standing Committees which are chosen by ballot; and to cause this list to be sent by mail to all the Resident Fellows of the Academy not later than four weeks before the Annual Meeting.

3. Independent nominations for any office, signed by at least five Resident Fellows and received by the Recording Secretary not less than ten days before the Annual Meeting, shall be inserted in the call for the Annual Meeting, which shall then be issued not later than one week before that meeting.

4. The Recording Secretary shall prepare for use, in voting at the Annual Meeting, a ballot containing the names of all persons nominated for office under the conditions given above.

5. When an office is to be filled at any other time than at the Annual Meeting, the President shall appoint a Nominating Committee in accordance with the provisions of Section 1, which shall announce its nomination in the manner prescribed in Section 2 at least two weeks before the time of election. Independent nominations, signed by at least five Resident Fellows and received by the Recording Secretary not later than one week before the meeting for election, shall be inserted in the call for that meeting.

CHAPTER IV.

Of the President.

1. It shall be the duty of the President, and, in his absence, of the senior Vice-President present, or next officer in order as above enumerated, to preside at the meetings of the Academy; to summon extraordinary meetings, upon any urgent occasion; and to execute or see to the execution of the Statutes of the Academy. Length of continuous membership in the Academy shall determine the seniority of the Vice-Presidents.

2. The President, or, in his absence, the next officer as above enumerated, is empowered to draw upon the Treasurer for such sums of money as the Academy shall direct. Bills presented on account of the Library, or the Publications of the Academy, must be previously approved by the respective committees on these departments.

3. The President, or, in his absence, the next officer as above enumerated, shall nominate members to serve on the different committees of the Academy which are not chosen by ballot.

4. Any deed or writing to which the common seal is to be affixed shall be signed and sealed by the President, when thereto authorized by the Academy.

CHAPTER V.

Of Standing Committees.

1. At the Annual Meeting there shall be chosen the following Standing Committees, to serve for the year ensuing, viz.: —

2. The Committee of Finance, to consist of the President, Treasurer, and one Fellow chosen by ballot, who shall have full control and management of the funds and trusts of the Academy, with the power of investing or changing the investment of the same at their discretion. The general appropriations for the expenditures of the Academy shall be moved by this Committee at the Annual Meeting, and all special appropriations from the general and publication funds shall be referred to or proposed by this Committee.

3. The Rumford Committee, of seven Fellows, to be chosen by ballot, who shall consider and report on all applications and claims for the Rumford Premium, also on all appropriations from the income of the Rumford Fund, and generally see to the due and proper execution of this trust.

4. The C. M. Warren Committee, of seven Fellows, to be chosen by ballot, who shall consider and report on all applications for appropriations from the income of the C. M. Warren Fund, and generally see to the due and proper execution of this trust.

5. The Committee of Publication, of three Fellows, one from each Class, to whom all communications submitted to the Academy for publication shall be referred, and to whom the printing of the Memoirs and the Proceedings shall be intrusted.

6. The Committee on the Library, of the Librarian ex officio and three other Fellows, one from each class, who shall examine the Library, and make an annual report on its condition and management.

7. An Auditing Committee of two Fellows, for auditing the accounts of the Treasurer.

CHAPTER VI.

Of the Secretaries.

1. The Corresponding Secretary shall conduct the correspondence of the Academy, recording or making an entry of all letters written in its name, and preserving on file all letters which are received; and at each meeting he shall present the letters which have been addressed to the Academy since the last meeting. Under the direction of the Council for Nomination, he shall keep a list of the Resident Fellows, Associate Fellows, and Foreign Honorary Members, arranged in their Classes and in Sections in respect to the special sciences in which they are severally proficient; and he shall act as secretary to the Council.

2. The Recording Secretary shall have charge of the Charter and Statute-book, journals, and all literary papers belonging to the Academy. He shall record the proceedings of the Academy at its meetings; and after each meeting is duly opened, he shall read the record of the preceding meeting. He shall notify the meetings of the Academy, apprise officers and committees of their election or appointment, and inform the Treasurer of appropriations of money voted by the Academy. He shall post up in the Hall a list of the persons nominated for election into the Academy; and when any individual is chosen, he shall insert in the record the names of the Fellows by whom he was nominated.

3. The two Secretaries, with the Chairman of the Committee of Publication, shall have authority to publish such of the records of the meetings of the Academy as may seem to them calculated to promote its interests.

CHAPTER VII.

Of the Treasurer.

1. The Treasurer shall give such security for the trust reposed in him as the Academy shall require.

2. He shall receive officially all moneys due or payable, and all bequests or donations made to the Academy, and shall pay such sums as the Academy may direct. He shall keep an account of all receipts and expenditures; shall submit his accounts to the Auditing Committee; and shall report the same at the expiration of his term of office.

3. The Treasurer shall keep separate accounts of the income and appropriation of the Rumford Fund and of other special funds, and report the same annually.

4. All moneys which there shall not be present occasion to expend shall be invested by the Treasurer, under the direction of the Finance Committee.

CHAPTER VIII.

Of the Librarian and Library.

1. It shall be the duty of the Librarian to take charge of the books, to keep a correct catalogue of them, to provide for the delivery of books from the Library, and to appoint such agents for these purposes as he may think necessary. He shall make an annual report on the condition of the Library.

2. The Librarian, in conjunction with the Committee on the Library, shall have authority to expend such sums as may be appropriated, either from the General, Rumford or other special Funds of the Academy, for the purchase of books, and for defraying other necessary expenses connected with the Library.

3. To all books in the Library procured from the income of the Rumford Fund, or other special funds, the Librarian shall cause a stamp or label to be affixed, expressing the fact that they were so procured.

4. Every person who takes a book from the Library shall give a receipt for the same to the Librarian or his assistant.

5. Every book shall be returned in good order, regard being had to the necessary wear of the book with good usage. If any book shall be lost or injured, the person to whom it stands charged shall replace it by a new volume or set, if it belongs to a set, or pay the current price of the volume or set to the Librarian; and thereupon the remainder of the set, if the volume belonged to a set, shall be delivered to the person so paying for the same.

6. All books shall be returned to the Library for examination at least one week before the Annual Meeting.

7. The Librarian shall have custody of the Publications of the Academy and shall distribute copies among the Associate Fellows and Foreign Honorary Members, at their request. With the advice and consent of the President, he may effect exchanges with other associations.

CHAPTER IX.

Of Meetings.

1. There shall be annually four stated meetings of the Academy; namely, on the second Wednesday in May (the Annual Meeting), on the second Wednesday in October, on the second Wednesday in January, and on the second Wednesday in March. At these meetings only, or at meetings adjourned from these and regularly notified, shall appropriations of money be made, or alterations of the statutes or standing votes of the Academy be effected.

2. Fifteen Fellows shall constitute a quorum for the transaction of business at a stated meeting. Seven Fellows shall be sufficient to constitute a meeting for scientific communications and discussions.

3. The Recording Secretary shall notify the meetings of the Academy to each Fellow residing in Boston and the vicinity; and he may cause the meetings to be advertised, whenever he deems such further notice to be needful.

CHAPTER X.

Of the Election of Fellows and Honorary Members.

1. Elections shall be made by ballot, and only at stated meetings.

2. Candidates for election as Resident Fellows must be proposed by two Resident Fellows of the section to which the proposal is made, in a recommendation signed by them, and this recommendation shall be transmitted to the Corresponding Secretary, and by him referred to the Council for nomination. No person recommended shall be reported by the Council as a candidate for election, unless he shall have received a written approval, signed at a meeting of the Council by at least five of its members. All nominations thus approved shall be read to the Academy at a stated meeting, and shall then stand on the nomination list during the interval between two stated meetings, and until the balloting. No person shall be elected a Resident Fellow, unless he shall have been resident in this Commonwealth one year next preceding his election. If any person elected a Resident Fellow shall neglect for one year to pay his admission fee, his election shall be void; and if any Resident Fellow shall neglect to pay his annual assessments

for two years, provided that his attention shall have been called to this article, he shall be deemed to have abandoned his Fellowship; but it shall be in the power of the Treasurer, with the consent of the Council, to dispense (*sub silentio*) with the payment both of the admission fee and of the assessments, whenever in any special instance he shall think it advisable so to do.

3. The nomination of Associate Fellows may take place in the manner prescribed in reference to Resident Fellows. The Council may in like manner originate nominations of Associate Fellows, which must be read at a stated meeting previous to the election, and be exposed on the nomination list during the interval.

4. Foreign Honorary Members shall be chosen only after a nomination made at a meeting of the Council, signed at the time by at least seven of its members, and read at a stated meeting previous to that on which the balloting takes place.

5. Three fourths of the ballots cast must be affirmative, and the number of affirmative ballots must amount to eleven to effect an election of Fellows or Foreign Honorary Members.

6. A majority of any section of the Academy is empowered to present lists of persons deemed best qualified to fill vacancies occurring in the number of Foreign Honorary Members or Associate Fellows allotted to it; and such lists, after being read at a stated meeting, shall be referred to the Council for Nomination.

7. If, in the opinion of a majority of the entire Council, any Fellow — Resident or Associate — shall have rendered himself unworthy of a place in the Academy, the Council shall recommend to the Academy the termination of his Fellowship; and provided that a majority of two thirds of the Fellows at a stated meeting, consisting of not less than fifty Fellows, shall adopt this recommendation, his name shall be stricken off the roll of Fellows.

CHAPTER XI.

Of Amendments of the Statutes.

1. All proposed alterations of the Statutes or additions to them, shall be referred to a committee, and, on their report at a subsequent meeting, shall require for enactment a majority of two thirds of the members present, and at least eighteen affirmative votes.

2. Standing votes may be passed, amended, or rescinded, at any

stated meeting, by a majority of two thirds of the members present. They may be suspended by a unanimous vote.

CHAPTER XII.

Of Literary Performances.

1. The Academy will not express its judgment on literary or scientific memoirs or performances submitted to it, or included in its publications.

STANDING VOTES.

1. Communications of which notice had been given to the Secretary shall take precedence of those not so notified.

2. Resident Fellows who have paid all fees and dues chargeable to them are entitled to receive one copy of each volume or article printed by the Academy, on application to the Librarian personally or by written order, within two years from the date of publication. And the current issues of the Proceedings shall be supplied, when ready for publication, free of charge, to all the Fellows and members of the Academy who desire to receive them.

3. The Committee of Publication shall fix from time to time the price at which the publications of the Academy may be sold. But members may be supplied at half this price with volumes which they are not entitled to receive free, and which are needed to complete their sets.

4. Two hundred extra copies of each paper accepted for publication in the Memoirs or Proceedings of the Academy shall be placed at the disposal of the author, free of charge.

5. Resident Fellows may borrow and have out from the Library six volumes at any one time, and may retain the same for three months, and no longer.

6. Upon special application, and for adequate reasons assigned, the Librarian may permit a larger number of volumes, not exceeding twelve, to be drawn from the Library for a limited period.

7. Works published in numbers, when unbound, shall not be taken from the Hall of the Academy, except by special leave of the Librarian.

8. Books, publications, or apparatus shall be procured from the income of the Rumford Fund only on the certificate of the Rumford Committee that they, in their opinion, will best facilitate and encourage the making of discoveries and improvements which may merit the Rumford Premium.

9. A meeting for receiving and discussing scientific communications may be held on the second Wednesday of each month not appointed for stated meetings, excepting July, August, and September.

RUMFORD PREMIUM.

In conformity with the terms of the gift of Benjamin, Count Rumford, granting a certain fund to the American Academy of Arts and Sciences, and with a decree of the Supreme Judicial Court for carrying into effect the general charitable intent and purpose of Count Rumford, as expressed in his letter of gift, the Academy is empowered to make from the income of said fund, as it now exists, at any Annual Meeting, an award of a gold and a silver medal, being together of the intrinsic value of three hundred dollars, as a premium to the author of any important discovery or useful improvement in light or in heat, which shall have been made and published by printing, or in any way made known to the public, in any part of the continent of America, or any of the American islands; preference being always given to such discoveries as shall, in the opinion of the Academy, tend most to promote the good of mankind; and to add to such medals, as a further premium for such discovery and improvement, if the Academy see fit so to do, a sum of money not exceeding three hundred dollars.

INDEX.

NOTE. For index to genera and species of "Flora of the Galapagos Islands," *see* pp. 263–269.

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